

SOME FEATURES OF THE SUPRAMOLECULAR STRUCTURES IN PETROLEUM MEDIA

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The structure of the disperse phase of crude oils and liquid petroleum products is determined by the characteristics of formation of molecular aggregates of asphaltenes. The characteristics of these processes in dilute solutions of crude oil in toluene were investigated by measuring the proton spin-spin relaxation time as a function of the concentration of asphaltenes. These measurements allowed explaining the conditions of formation of dimers and more complex aggregates of asphaltene molecules. The data obtained by the NMR-relaxation method are confirmed by the results of measurements of the viscosity and optical absorption of the petroleum solutions investigated.

The performance and user properties of crude oils and many petroleum products such as heavy fuels and viscous oils and greases are determined to a significant degree by the presence of various molecular aggregates in these liquids. The highest capacity for formation of aggregates in petroleum media is characteristic of the molecules of asphaltenes. Colloidal aggregates of these molecules affect the rate of formation of residues on the surfaces of the equipment, the stability of emulsions, the efficiency of catalysts, etc.

Such supramolecular formations have been relatively well investigated only in disperse media with a relatively high (of the order of several percent) asphaltene content [1, 2]. The large size and complexity of the structure of these aggregates makes it difficult to study the mechanisms of molecular association and possible existence of asphaltenes in the form of individual molecules (monomers).

We elucidated the conditions for observing asphaltene monomers in petroleum media and investigated the characteristics of formation of the simplest supramolecular structures – dimers, trimers, etc. All of the

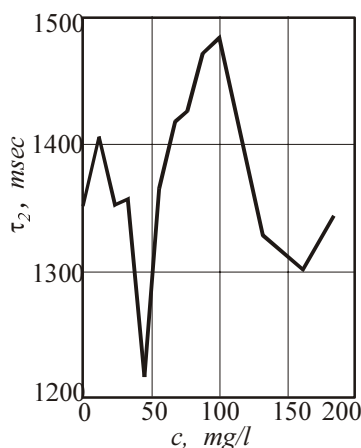


Fig. 1. Proton spin-spin relaxation time τ_2 vs. concentration of asphaltenes c in solutions of crude oil in toluene.